PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Piotr KULA et al.	Group Art Unit: 1742
Application No.: 10/531,690	Examiner: W. ZHU
Filed: April 15, 2004	Docket No.: 122083

For: HYDROGEN GAS MIXTURE FOR THE UNDER-PRESSURE CARBURIZING OF STEEL

DECLARATION UNDER 37 C.F.R. §1.132

I, Piotr Kula, a citizen of Poland, hereby declare and state:

1. I have a degree in mechanical engineering, materials science and heat treating of metals which was conferred upon me by Politechnika Lodzka (Poland) in 1975.

2. I have been employed by Politechnika Lodzka since 1975 (since 1996 as professor), and I have had a total of 20 years experience in the field of steel carburizing.

3. I am a named inventor in the above-captioned patent application. I am familiar with the patent application.

4. I have a professional relationship with the Assignee, Seco/Warwick SP.ZO.O. and Politechnika Lodzka, of the above-identified patent application. In the course of that professional relationship, I received compensation directly from Seco/Warwick SP.ZO.O and Politechnika Lodzka. for my work relating to research and development regarding steel carburization.

5. I and/or those under my direct supervision and control have conducted the following experiment, which uses acetylene, ethylene and hydrogen at various compositions and proportions to carburize steel in a low pressure vacuum furnace chamber.

The experimental results demonstrate that the presently claimed acetylene/ethylene mixture for under-pressure carburizing steel achieves unexpected results in carbon carrier consumption when compared to Japanese Patent Publication No. 2000-001765 (hereinafter "JP 765"') in which a gas mixture with a different ratio of acetylene to ethylene (only 0.428) is used to vacuum carburize steel.

In JP 765, a gas mixture comprising 70% ethylene gas and 30% acetylene gas, with a ratio of acetylene to ethylene of 0.428, was introduced into a vacuum carburization furnace at a low pressure (1 to 10 kPa).

For comparison, three samples of low carbon steel 17CrNi with deep, narrow hollows of intricate shapes and a total surface area of 0.4 m^2 were heated in a vacuum carburization furnace. After the furnace temperature reached 950°C, six different acetylene/ethylene mixtures were introduced with hydrogen at a constant pressure of 5 mbar for twenty minutes. During this time, a mass spectrometer measured chemical composition of the acetylene/ethylene leaving the vacuum furnace chamber. Finally, the three samples of low carbon steel were heated in a vacuum and subsequently cooled to ambient temperature.

As shown below in Table 1, samples A, B, C, D, E, and F represent the six different mixtures. Samples D and E, with acetylene to ethylene ratios of 0.69 to 1, respectively, are within the presently claimed range of 0.55 - 2.0.

Table 1

Processes	A	B	C	D	E	F
Acetylene (% Composition of Mixture)	0	5	13	23	27	40
Ethylene (% Composition of Mixture)	80	70	55	33	27	0
Hydrogen (% Composition of Mixture)	20	25	32	44	46	60
Acetylene and Ethylene Ratio in Carbon Carrier	0	0.07	0.23	0.69	1.0	infinite
Hydrogen to Carbon Carrier ratio in the mixture (1/min)	4.0	3.0	2.13	1.27	1.17	0.66
Carbon Carrier Consumption	266	215	166	76	70	62
Carburizing Uniformity	-	+/-	+	+	+	+
Charge Cleanness after Process	+	+	+	+	+	-

As shown above in Table 1, the carbon carrier consumption between comparative sample C and sample D (representative of the present claims), decreased unexpectedly by a factor of two when the acetylene to ethylene ratio was increased from 0.23 to 0.69, while generating uniform carburized layers with no accumulation of soot or tar on the furnace chamber. Thus, the results in Table 1 demonstrate that the acetylene to ethylene ratio of 0.55 to 2 is necessary to achieve a uniformly carburized layer with no accumulation of soot or tar. JP 765, with an acetylene/ethylene ratio outside of this range, does not achieve such results.

6. I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and

further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine and/or imprisonment under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing therefrom.

Date: 12. 11. 2007. P. Kula - professor

Piotr Kula